

L2-(3.2) Characteristics of Quadratic Relations

Key Concepts:

- vertex
- zeroes *x intercepts roots*
- where are they?
- how many? 0, 1, or 2
 - axis of symmetry
 - direction of opening
 - optimal value
- maximum or minimum?

The vertex is the highest or lowest point on the parabola, and we refer to its coordinates as (h, k) .

The axis of symmetry is the vertical line passing through the vertex, having the equation $x = h$.

If the parabola opens up, the coefficient of x^2 is positive:

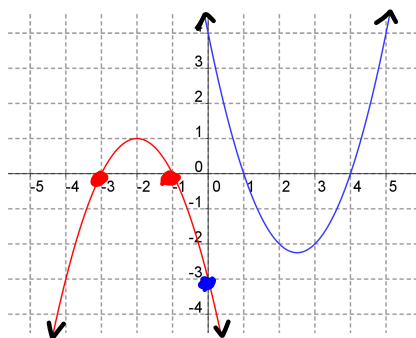
- the vertex is the lowest point
- the minimum (or optimum) value is k

If the parabola opens down, the coefficient of x^2 is negative:

- the vertex is the highest point
- the maximum (or optimum) value is k

Ex.1. Consider the two graphs:

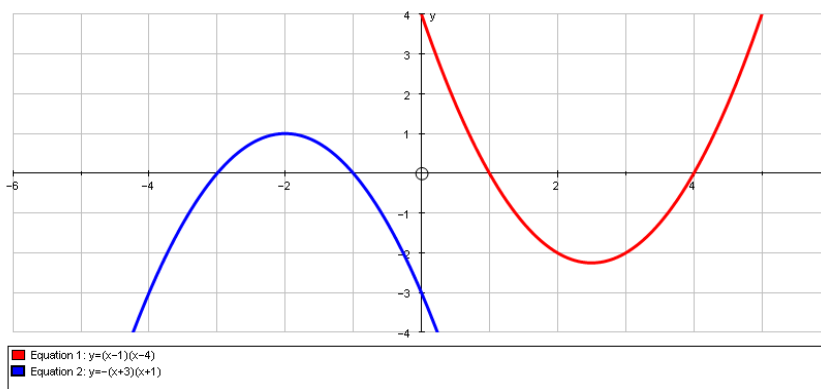
Can you deduce values for each of the following?



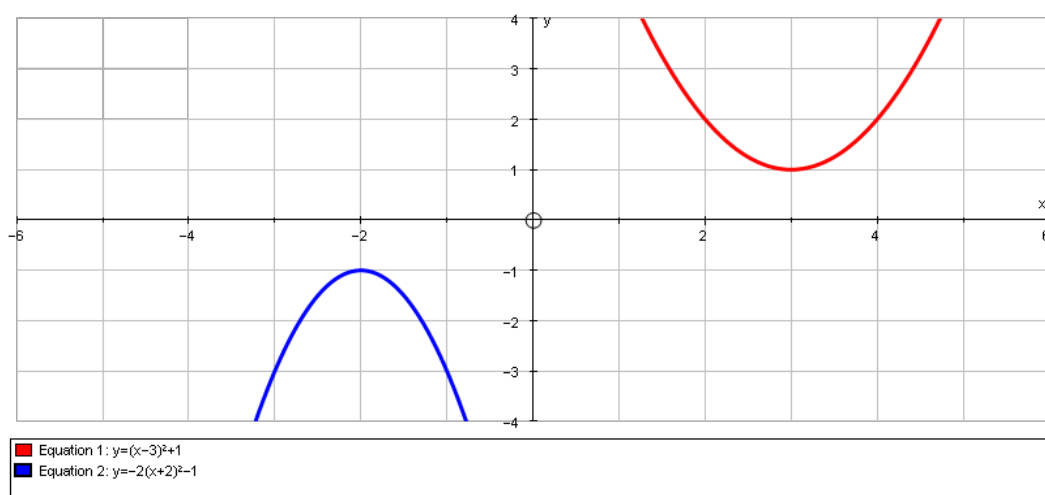
| Property | $y = -x^2 - 4x - 3$ | $y = x^2 - 5x + 4$ |
|----------------------|-----------------------|--------------------|
| Direction of Opening | Down | Up |
| Maximum or Minimum | MAX | Min |
| Number of Zeroes | 2 | 2 |
| Axis of Symmetry | $x = -2$ | $x = 2.5$ |
| Location of Vertex | $(-2, 1)$ | $(2.5, -2.25)$ |
| Location of Zeroes | $(-3, 0)$ & $(-1, 0)$ | 1 and 4 |
| y-intercept | -3 | 4 |

If the parabola crosses the x-axis, the x-coordinates of the crossing points are called the zeroes, or roots, or x-intercepts.

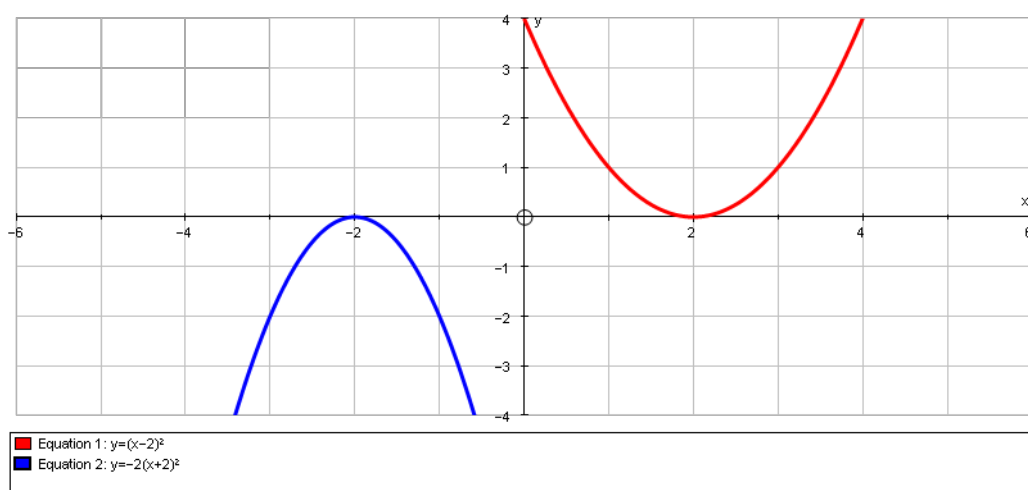
A parabola may have two zeros:



Or no zeroes:



Or one zero:



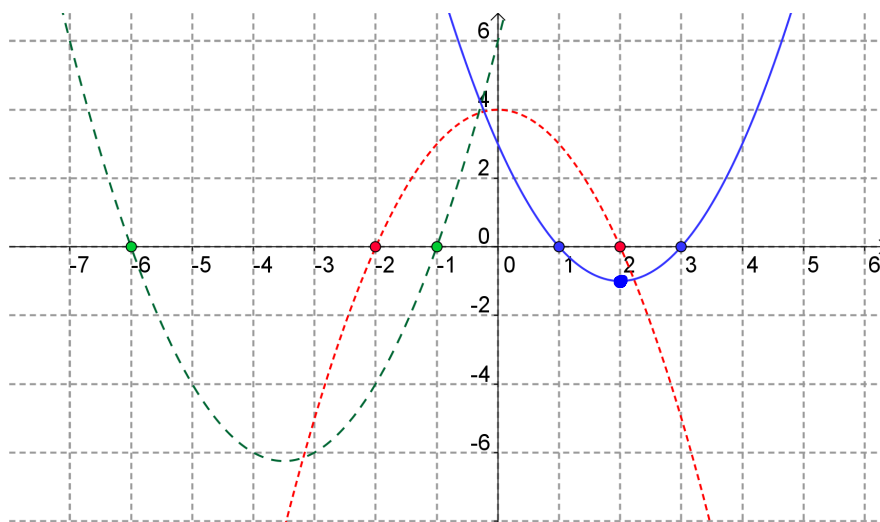
Vertex (#, 0)

Ex.2. From your graphs, determine key features of each.

$$y = x^2 - 4x + 3$$

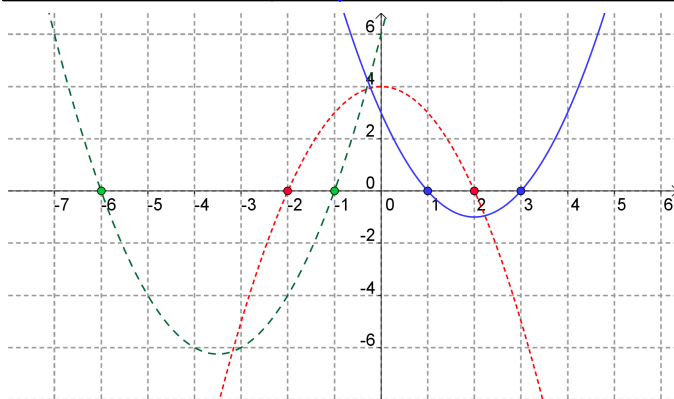
$$y = -x^2 + 4$$

$$y = x^2 + 7x + 6$$



$$y = x^2 - 4x + 3 \quad y = -x^2 + 4 \quad y = x^2 + 7x + 6$$

| | | | |
|------------------|-----------|----------|----------------|
| vertex | $(2, -1)$ | $(0, 4)$ | $(-3.5, -6.1)$ |
| opening | Up | Down | Up |
| max/min? | min | MAX | min |
| max/min value | -1 | 4 | -6.1 |
| y-intercept | 3 | 4 | 6 |
| zeroes | 1 and 3 | -2 and 2 | -6 and -1 |
| axis of symmetry | $x = 2$ | $x = 0$ | $x = -3.5$ |



Assigned Work:

p. 145 # 1-6, 7ef, 9ab